

# Tuberculosis among immigrants: interval from arrival in Canada to diagnosis

## A 5-year study in southern Alberta

Robert L. Cowie, MD; Jill W. Sharpe, BN

### Abstract

**Objective:** To examine the pattern of tuberculosis (TB) occurring among immigrants and the interval from arrival in Canada to diagnosis of the disease.

**Design:** Study of all cases of TB diagnosed in foreign-born residents of southern Alberta during the 5-year period 1990–1994.

**Setting:** A centre for the diagnosis, management and control of all cases of TB in the southern half of the province of Alberta.

**Methods:** All foreign-born patients in whom TB was newly diagnosed between January 1990 and December 1994 were included in the study. The interval from their arrival in Canada to diagnosis, their country of birth and the site of their disease were documented.

**Results:** Immigrants to Canada accounted for 248 (70.6%) of the 351 cases of TB diagnosed in southern Alberta during the 5-year period. The majority of these immigrants (182/248 [73.4%]) were of Asian origin. Extrapulmonary TB accounted for 111 (61.0%) of the 182 cases of the disease in Asian immigrants. The mean period between immigration and diagnosis was 11.2 years (standard deviation [SD] 13.9 years). Half of the patients presented within 7 years of their arrival in Canada. The time to presentation was shortest for patients with superficial lymph node disease (mean 7.6 years [SD 6.9] after arrival), intermediate among those with extrapulmonary disease, excluding superficial disease of the lymph node (10.1 years [SD 12.1]), and longest for those with pulmonary disease (14.2 years [SD 17.2]). TB developed sooner after arrival in Canada among immigrants from Asian countries (mean 9.1 years) than among those from other countries (17.2 years) ( $p = 0.01$ ).

**Conclusions:** Given the low annual incidence of TB in Canada (7.1 per 100 000), it is probable that TB occurring among immigrants reflects infection acquired before arrival in Canada. Health care professionals need to be aware that immigrants from countries with a relatively high prevalence of TB remain at risk for the disease (often at an extrapulmonary site) for many years after they immigrate to low-prevalence countries.

### Résumé

**Objectifs :** Examiner la tendance de la tuberculose chez les immigrants et l'intervalle écoulé entre leur arrivée au Canada et le diagnostic de la maladie.

**Conception :** Étude de tous les cas de tuberculose diagnostiqués chez des résidents d'origine étrangère du sud de l'Alberta au cours de la période de 5 ans écoulée de 1990 à 1994.

**Contexte :** Un centre de diagnostic, de traitement et de contrôle de tous les cas de tuberculose dans la partie sud de l'Alberta.

**Méthodes :** L'étude a porté sur tous les patients d'origine étrangère chez lesquels on a diagnostiqué une tuberculose entre janvier 1990 et décembre 1994. L'intervalle écoulé entre l'arrivée au Canada et le moment où l'on a posé le diagnostic, le pays d'origine et le site de la maladie ont été documentés.

**Résultats :** Les immigrants entrés au Canada ont représenté 248 (70,6 %) des 351 cas de tuberculose diagnostiqués dans le sud de l'Alberta au cours de la période



### Evidence

### Études

Dr. Cowie and Ms. Sharpe are with Tuberculosis Services for Southern Alberta, Foothills Provincial General Hospital, Calgary, Alta.

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‡ See related articles pages 605 and 611

de 5 ans. La plupart de ces immigrants (182/248 [73,4 %]) étaient d'origine asiatique. La tuberculose était extrapulmonaire dans 111 (61,0 %) des 182 cas enregistrés chez les immigrants asiatiques. Il s'est écoulé, entre l'immigration et le diagnostic, 11,2 ans en moyenne (écart type [ET] de 13,9 ans). La moitié des patients se sont présentés dans les 7 ans suivant leur arrivée au Canada. Le délai écoulé avant la consultation a été le plus court chez les patients atteints de la maladie des ganglions lymphatiques superficiels (moyenne de 7,6 ans [ET de 6,9] après leur arrivée), de durée intermédiaire chez les cas de maladie extrapulmonaire à l'exclusion de la maladie des ganglions lymphatiques superficiels (10,1 ans [ET de 12,1]) et le plus long chez les sujets atteints de pneumopathie (14,2 ans [ET de 17,2]). La tuberculose s'est manifestée après leur arrivée au Canada, plus rapidement chez les immigrants des pays asiatiques (moyenne de 9,1 ans) que chez ceux d'autres pays (17,2 ans) ( $p = 0,01$ ).

**Conclusions :** Comme l'incidence annuelle de la tuberculose au Canada est faible (7,1 pour 100 000 habitants), il est probable que la tuberculose qui fait son apparition chez les immigrants découle d'une infection acquise avant leur arrivée au Canada. Les professionnels de la santé doivent savoir que les immigrants provenant des pays où la prévalence de la tuberculose est relativement élevée risquent d'être victimes de la maladie (souvent à un site extrapulmonaire) pendant des années après avoir immigré dans des pays où la prévalence est faible.

The last 3 decades have seen sharp increases in the migration of people from poorly developed countries to the industrialized regions of the world.<sup>1</sup> This migration has led to rapid changes in demographic characteristics and in the incidence and distribution of tuberculosis (TB) in countries where, until recently, the disease has been spoken of largely in the past tense.<sup>1,2</sup>

People born outside Canada currently account for an estimated 17% of the population in southern Alberta. Immigrants to Canada are screened for evidence of pulmonary TB and are treated before immigration if active disease is diagnosed. Those judged to have inactive pulmonary TB are required to attend a TB facility after their arrival in Canada and are offered chemoprophylaxis once the inactive nature of their disease has been confirmed. This process is designed to minimize the risk of TB among immigrants and is important as they enter a country where the disease is uncommon and may not be readily diagnosed. In this 5-year study we examined the pattern of TB occurring in immigrants to southern Alberta, including the interval between arrival in Canada and diagnosis.

## Population and methods

Tuberculosis Services for Southern Alberta manages all cases of TB diagnosed in the population of the southern half of the province (approximately 1.2 million). Data relating to these cases were collected during the 5-year period from January 1990 to December 1994. The data were stored in Alberta's provincial TB database, and additional information was recorded in a separate database. At the time of diagnosis, information was collected from the patient and, for those born outside Canada, from immi-

gration documents; this information included age, sex, country of birth and year of arrival in Canada (if applicable). The site or sites of TB were determined from the clinical, radiologic, mycobacterial and histologic information, and these data together with the method of diagnosis were recorded. Cases of TB with lung involvement (excluding disseminated TB) were classified as pulmonary TB irrespective of involvement at other sites and irrespective of the presenting site. Thus, for example, a patient with proven TB of the cervical lymph node was listed as having pulmonary TB if there was radiologic evidence suggesting post-primary pulmonary TB.

This report includes all of the cases of TB diagnosed in those born outside Canada for the 5-year period of the study. The data were analysed to determine the period from arrival in Canada to diagnosis and to relate that interval to the country of origin, the age of the subject and the site of disease. The age data were analysed with Student's *t*-test or analysis of variance, and data relating to the period to diagnosis were analysed with the Kruskal-Wallis test for 2 groups or the Kruskal-Wallis one-way analysis of variance (EpiInfo, ver. 6, Centers for Disease Control and Prevention, Atlanta, 1994).

## Results

A total of 351 new cases of TB were diagnosed in southern Alberta during the 5-year period of this study, and the annual incidence of the disease in this region was 5.8 per 100 000 (95% confidence interval 4.9 to 7.2). Immigrants to Canada accounted for 248 (70.6%) of the cases. On the basis of a mid-study estimate that foreign-born residents accounted for 16% of the population of



southern Alberta, the annual incidence of TB in this group was 25.8 per 100 000, which is more than 21 times greater than the annual incidence among Canadian-born, nonaboriginal residents (1.2 per 100 000). Of the immigrants, 182 (73.4%) were born in Asia and 66 in other regions. Most of the Asian immigrants were from China, Hong Kong, Vietnam, the Philippines and the Indian subcontinent.

The median period between arrival in Canada and diagnosis of TB was 7 years; the mean period was 11.2 years (standard deviation [SD] 13.9 years). The disease was diagnosed within 1 year of arrival in 24 immigrants, of whom 11 had only extrapulmonary disease. The screening program whereby immigrants suspected of having inactive TB are required to report for assessment resulted in the detection of 24 (10%) of the cases of TB among immigrants. The diagnosis was made within a mean of 0.5 years (SD 0.6) after arrival in Canada for those detected through the immigrant screening program; this period was significantly shorter than the average 12.3 years (SD 14.2) for the other cases among immigrants ( $p < 0.001$ , Kruskal-Wallis 2-sample test). Analysis by age categories (decades) for the 234 immigrants who were between 10 and 79 years of age at the time of immigration showed no significant difference in the period between arrival and diagnosis on the basis of age at immigration ( $p = 0.17$ , Kruskal-Wallis one-way analysis of variance), although there was a trend for a longer period to diagnosis among younger immigrants. There was no significant difference in mean age between immigrants with TB who were born in Asia and those born in other regions. However, the mean interval between arrival in Canada and diagnosis of disease was shorter for those from Asia (9.1 years, SD 11.7) than for those born in other regions (17.2 years, SD 17.5) ( $p = 0.01$ , Kruskal-Wallis 2-sample test). Only 100 (40.3%) of the cases were diagnosed within 5 years, and half of the patients (124) presented 7 years or more after arrival. Other comparisons between immigrants

with TB born in Asia and those born in other regions are presented in Table 1.

The site of TB was related to the interval between arrival and diagnosis. This interval was shortest for patients with lymph node disease (mean 7.6 years, SD 6.9), intermediate for those with non-lymph node extrapulmonary disease (mean 10.1 years, SD 12.1) and longest for those with pulmonary disease (mean 14.2 years, SD 17.2) ( $p = 0.3$ , Kruskal-Wallis one-way analysis of variance). Table 2 compares the median period between arrival and diagnosis for the different sites of disease among Asian and other immigrants. Two cases of primary disease developed 1 and 3 years after arrival in 2 non-Asian children aged 3 and 5 years respectively.

Chemoprophylaxis with isoniazid had been offered and accepted by 6 of the foreign-born patients in whom TB subsequently developed. TB was diagnosed by mycobacterial culture in 5 of these patients, and in each case the organism was susceptible to isoniazid.

## Discussion

It is important that immigrants to Canada be assessed for TB before they arrive in this country and that arrangements be made for initial surveillance of those with evidence of pulmonary TB on pre-immigration chest radiographs. The risk of TB for immigrants is the same as prevails in their countries of origin,<sup>3</sup> but there may be little general awareness among physicians that foreign-born residents remain at significant risk for many years after their arrival in Canada. Other North American studies have suggested that most cases of TB develop within the first 5 years after immigration.<sup>4,5</sup> However, only 40% of the cases in the present study were diagnosed within 5 years of arrival, and in half of the cases, the disease developed more than 7 years after immigration. The nature of this study might hide a relation between the date of an immigrant's arrival and the interval to presentation with TB. For example, earlier immigrants might have been more likely to de-

**Table 1: Characteristics of immigrants with tuberculosis (TB), southern Alberta, 1990-1994**

Characteristic	Region of origin		<i>p</i> value
	Asia* <i>n</i> = 182	Other <i>n</i> = 66	
Age, yr (and SD†)			
On arrival	40.5 (19.3)	29.7 (16.6)	< 0.001‡
At diagnosis	49.6 (20.3)	46.9 (23.7)	0.6‡
Sex ratio, male:female	78:104	35:31	0.2§
Disease-site ratio, extrapulmonary:pulmonary	111:71	20:46	< 0.001§

\*China, Hong Kong, Vietnam, Philippines, Indian subcontinent, Korea, Cambodia, Indonesia and Laos (the majority of Asian immigrants were from the first 5 of these countries).

†SD = standard deviation.

‡Student's *t*-test.

§ $\chi^2$  test.

||Ratio of extrapulmonary TB (including disease of the lymph nodes) to pulmonary TB, in terms of numbers of patients. Extrapulmonary disease was defined as disease with no evidence of lung involvement, other than that associated with disseminated TB (which was also included in this category).

**Table 2: Median period from arrival in Canada to diagnosis of TB**

Location of disease	Region of origin; median period (and range), yr		<i>p</i> value*
	Asia <i>n</i> = 71	Other <i>n</i> = 46	
Pulmonary	6.0 (< 1 to 78)	14.5 (< 1 to 65)	0.005
Extrapulmonary			
Non-lymph node	7.0 (< 1 to 71) <i>n</i> = 46	8.0 (1 to 42) <i>n</i> = 14	0.8
Lymph node	5.0 (< 1 to 23) <i>n</i> = 65	4.5 (< 1 to 36) <i>n</i> = 6	0.2
All cases	6.0 (< 1 to 78) <i>n</i> = 182	11 (< 1 to 65) <i>n</i> = 66	0.01

\*Kruskal-Wallis test for differences in mean periods between arrival in Canada and diagnosis of TB.

lay presentation than more recent immigrants to Canada because they were less familiar with access to health care services. Changing levels of awareness of TB among physicians might also have influenced the period to diagnosis. The apparently longer median period between immigration and diagnosis of TB in this study relative to previous studies from North America<sup>4,5</sup> suggests that if any change has occurred it is an increase in the delay to diagnosis.

The structure of this study did not allow us to be confident that the apparently shorter period between arrival and diagnosis of TB among immigrants from Asia reflected a true difference rather than a changing pattern of immigration to Canada from Asia and from other regions over time.

During the period of this study, the annual incidence of TB in southern Alberta (5.8 per 100 000, 95% confidence interval 4.9 and 7.2) did not differ significantly from the Canadian incidence of 7.1 per 100 000.<sup>6</sup> Precise population data are not available, but we estimated from information in the southern Alberta database that the annual incidence of TB among all foreign-born residents was 21 times higher than that among Canadian-born nonaboriginal residents. It can therefore be anticipated that the expected increase in the proportion of foreign-born residents in the Canadian population will be associated with an increase in the incidence of TB.

Some doubt remains from a study of this sort as to the origin of infection in immigrants who first display features of disease several years after their arrival in Canada. The tendency for immigrants to live in communities with other immigrants might be thought to increase their risk of acquiring TB after immigration.<sup>3</sup> However, in such communities in southern Alberta, the annual incidence of TB was estimated at 25.8 per 100 000, which is substantially lower than the incidence in the countries of origin.<sup>7</sup> Although it seems likely that infection was acquired in the country of origin, the source of infection is of less relevance than the continued high risk for development of the disease.<sup>8</sup>

The high proportion of extrapulmonary TB in this patient population was not associated with HIV infection.<sup>9</sup> The majority of immigrants from Asia (61.0%) presented with extrapulmonary TB.<sup>9</sup> This has favourable public health implications, given that extrapulmonary disease is rarely infectious. However, the occurrence of TB in an extrapulmonary location does enhance the risk of delay in diagnosis, with attendant risks of increased morbidity and death.<sup>10,11</sup>

It might be considered appropriate to offer chemoprophylaxis with isoniazid to tuberculin-positive immigrants. However, the risks of such therapy might outweigh the benefits, given that the average age on arrival in Canada of the immigrants in whom TB developed was 38 years and the risk of isoniazid-induced toxic effects in the liver increases significantly above the age of 35 years.<sup>12</sup> In addition, the benefits from such therapy may be further re-

duced because of the frequency of isoniazid-resistant *Mycobacterium tuberculosis* in those infected in Asia.<sup>13,14</sup> Compliance with preventive therapy may also be particularly poor among Asian immigrants.<sup>15</sup>

In Canada and other countries with a low prevalence of TB and an increasing immigrant population, physicians need to be aware that immigrants remain at increased risk for TB. Educational material could be developed and supplied to physicians identified with immigrant communities. An additional or alternative approach would be to provide all immigrants with information sheets, which they could pass on to their physicians should they experience symptoms compatible with TB. Any such endeavour should be linked with a process of evaluation to determine the role of such intervention in the investigation and diagnosis of TB.

This study has shown that the increased risk of TB among immigrants persists for many years after their arrival in Canada. Extrapulmonary TB is particularly common among Asian immigrants. Although this form has less public health significance than pulmonary TB, it is often more difficult to recognize and diagnose.

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**Reprint requests to:** Dr. Robert L. Cowie, Tuberculosis Services for Southern Alberta, Foothills Provincial General Hospital, 1403-29 St. NW, Calgary AB T2N 2T9; fax 403 297-3845; cowie@acs.ucalgary.ca